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UNITED STATES
DEPARTMENT OF AGRICULTURE
DEPARTMENT CIRCULAR 390
Washington, D. C. September, 1926

STUDY OF OFF-TYPE PLANTS OF ACALA COTTON

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INTRODUCTION

Off-type plants occur in all fields of cotton, but the varieties and even the stocks of the same variety differ widely in the numbers of such plants. The uniformity of a variety, which determines the value of seed stocks, is largely a matter of the frequency or infrequency of off-type plants. Although the importance of removing off-type plants from fields that are to be used as a source of seed supply is generally recognized,[1] little information has been published on this subject as a basis for practical work with cotton. Cook[2] has published a brief account of progenies of off-type Triumph or Mebane plants which gave examples of definite inheritance of plant type, boll characters, and peculiarities of lint and seeds. Also, progenies of variations of the Lone Star variety in Texas have been studied by W. W. Ballard, who obtained further evidence that the divergent characters were inherited; but the results of these investigations have not been published.

The purpose of this paper is to present data on inheritance of off-type characters in progenies of aberrant plants of Acala cotton raised at the United States Field Station, Sacaton, Ariz., in 1924. The

[1] COOK, O. F. COTTON SELECTION ON THE FARM BY THE CHARACTERS OF THE STALKS, LEAVES, AND BOLLS. U. S. Dept. Agr., Bur. Plant Indus. Circ. 66, 23 p. 1910.
[2] COOK, O. F. LOCAL ADJUSTMENT OF COTTON VARIETIES. U. S. Dept. Agr., Bur. Plant Indus. Bul. 159, 75 p. 1909.

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information will make clearer the need of continued selection and will assist in the recognition of the off-type plants or rogues that appear in this variety. Some doubt exists as to whether certain off-type characters are heritable and whether plants showing these characters are capable of contaminating the seed stocks, since many off-type plants appear very productive, notably the so-called "cluster" variations with short-jointed fruiting branches. The range of plant forms included in this experiment covers some of these types, and the results establish them as highly undesirable in any stock of cotton that is to be kept in a condition of productive uniformity.

Many of the off-type progeny rows were surprisingly uniform, especially when it is considered that all the seed was open pollinated. Such uniformity may indicate a dominance of the variations or off-type characters. In other cases where progenies were diverse it seemed not worth while to search for inheritance in Mendelian ratios or to speculate regarding the ancestry of the parent plants which under the conditions of open pollination might represent crosses of off-type plants of preceding generations. The nature of the off-type characters was such that detailed measurements are not necessary for recognition, and most of the data are in descriptive form. Usually the resemblance of off-type characters in the parent selection and in the progeny was very apparent, though in some cases notably modified by cultural conditions.

HISTORY OF PARENTAL SEED STOCKS

The parent plants of the off-type progenies hereinafter discussed were found in two stocks of Acala cotton at Sacaton, Ariz., in 1923. The seed for these plantings was from the Coachella Valley, Calif., where it had been grown the previous two years under conditions of isolation from other varieties and ginned separately.

One stock of the Coachella Valley seed was grown in a field at Sacaton over half a mile from other varieties, so that diversity in the progeny rows would not be ascribed to any recent hybridization, although some back crossing with normal Acala no doubt occurred.

The other stock of seed was grown at the United States Field Station at Sacaton, adjacent to Pima Egyptian and not far from a series of upland varieties. Numerous first-generation hybrids with Pima appeared in the progeny rows from this stock in 1924, but they are not considered in the following discussion. Some of the individual diversities shown in the progeny rows of off-type plants, as described later, probably were the result either of back crossing with normal Acala or of crossing with other upland varieties in the previous year. Such crossing, however, would only tend to reduce the abnormal forms in the more aberrant progenies and would not materially change the conclusions regarding the inheritance of the off-type characters.

CHARACTERS OF THE PARENT OFF-TYPE PLANTS

It has been found in breeding work with the Acala variety that most of the off-type plants can be grouped by certain outstanding features into a few general classes, although probably no two of the off-type individuals if carefully compared would have been found

very closely alike. For convenience of designation of the classes treated in this experiment a descriptive title has been used, based primarily on the type of leaf, stalk, and fruiting branch. It was found that about six classes covered the majority of diversities, apart from the more degenerate abnormalities that are occasionally found.

DESCRIPTION OF PLANT TYPES

(1) *Typical plant type.*—This group covers all plants that had the typical Acala stalk, leaf, and fruiting branch; that is, plants with an upright medium-large central stem, normal, medium-sized leaves, fruiting-branch internodes from 1 to 4 inches long, and an average internode length of about 2 inches. Type plants are illustrated in Plate 1, *b*, and in Plate 2, Figure 1, *a*, which show Acala plants normal in all characters. A row of plants termed typical in plant form is shown in Plate 3, Figure 1, but these plants had small bolls and short lint.

(2) *Open plant type.*—This group differs from the first only in length of fruiting-branch internodes. Open-type plants with the majority of the internodes 4 inches or more in length made up this class. Usually they were very unproductive. The plant type is illustrated in Plate 1, *e*, and a progeny row is shown in Plate 3, Figure 2.

(3) *Close plant type.*—All plants that had short-jointed fruiting branches comprised this group. Internode lengths were irregular, sometimes as much as 3 inches, but with the greater number of internodes only one-half to 1 inch long. As a rule the fruiting branches had a few decurrent pedicels. A close-type plant is shown in Plate 1, *c*.

(4) *Cluster plant type.*—Only plants with short fruiting-branch internodes and many decurrent pedicels were classed as cluster plants. Plate 1, *d*, Plate 2, Figure 1, *b*, *c*, and *f*, and Plate 2, Figure 2, *a*, *b*, and *f*, are all good examples of this group. Not infrequently the cluster plants were very productive, but many nearly sterile individuals also were found, similar to that shown in Plate 2, Figure 2, *f*.

(5) *Pole-cluster plant type.*—Plants of this type were usually cluster or semicluster in fruiting-branch characters, but were distinguished from the preceding type by their tall and very erect main stalk. Good examples of this group are shown in Plate 2, Figure 1, *b*, and the progeny row is illustrated in Plate 4, Figure 1.

(6) *Small-leafed plant type.*—These plants had small leaves and short stalks, seldom over 18 inches high, and fruited and stopped growth early in the season. They were usually rather short jointed, with small bolls. The type is illustrated in Plate 1, *a*.

CLASSIFICATION OF BOLL, LINT, AND SEED CHARACTERS

After the plant type was determined, further classification was made as to characters of the boll, lint, and seed.

Five general descriptive terms were used in classifying the bolls. *Typical* bolls included those ovate-oblong in shape, requiring about 75 to 80 to produce 1 pound of seed cotton. *Small* bolls were typical in shape but required more than 90 to the pound. (See Table 2, progenies 1, 12, and 17.) *Large* bolls were those requiring 70 bolls or less for a pound of seed cotton. *Long* bolls were more pointed than

the typical. *Round* bolls differed from typical in being less pointed. In some cases the same bolls were classed under two boll types, as *small* and *round*.

The lint of each plant was classified under five types: *Typical* lint, covering lint lengths from $1\frac{1}{16}$ to $1\frac{3}{16}$ inches (pl. 5, *a*); *short* lint, for lengths less than $1\frac{1}{16}$ inches (pl. 5, *b*, and *c*); *long* lint for lengths more than $1\frac{3}{16}$ inches; *butterfly* lint, when the mass of lint on one end of the seed is obviously longer than that on the other end; *sparse* lint, when lint on the seed is not abundant. This latter is a variable character, measured statistically, since it is the ratio of the weight of the lint to the weight of the seed. With small or light seed the percentage of lint appears greater. Typical abundance should be about 32 per cent lint and about 6 grams of lint per 100 seeds. Note the difference in lint abundance per seed as illustrated in combed samples in Plate 5 and in boll, lint, and seed data in Table 2. Combinations of length with other characters were sometimes used.

Seven classes of seeds were recognized in recording the variations: (1) *Typical*, which were medium-sized oblong seeds with dense grayish fuzz, weighing about 13 or 14 grams per 100 (see Table 2 and pl. 5, *a*); (2) *small*, seeds smaller than typical, weighing on an average less than 12 grams per 100 (see Table 2 and pl. 5, *c*); (3) *large*, seeds larger than typical, weighing on the average over 15 grams per 100; (4) *white fuzz*, seeds with fuzz lighter in color than typical; (5) *dark fuzz*, seeds with fuzz darker than typical; (6) *green fuzz*, seeds with distinctly greenish fuzz; and (7) *naked*, or "slick," seeds with little or no fuzz. Two characters were often combined in describing the seed.

Instead of detailed descriptions of each of the parent off-type plants, the general characters of each plant are recorded in Table 1 in terms of the preceding classification. The grouping of the progenies by plant-type characters shows the varied combinations with other characters of the boll, lint, and seed.

TABLE 1.—*General characteristics of each of the parent off-type plants of Acala cotton*

Plant No.	Plant type	Boll type	Lint type	Seed type	Plant No.	Plant type	Boll type	Lint type	Seed type
1	Typical	Typical	Short, sparse, butterfly.	Small, dark.	21	Open	Small	Typical	Typical.
2	do	do	Short, sparse.	Green.	22	do	Typical	do	Do.
3	do	do	do	Small, slick.	23	do	Small	Long	Do.
4	do	do	Short	Large, white.	24	Close	do	Typical	Do.
5	do	Small	do	Typical.	25	do	Small, round.	Short	Green.
6	do	Typical	Typical	Dark.	26	do	Typical	Typical	Typical.
7	do	do	Sparse	Green.	27	Cluster	do	do	Brown.
8	do	do	do	Do.	28	do	do	do	Typical.
9	do	do	Short	Dark.	29	do	do	do	Do.
10	do	Small	Short, sparse.	Small, green.	30	do	do	Short, sparse.	Green.
11	Open	Large	Typical	Typical.	31	do	Small	Typical	Typical.
12	do	Small	do	Do.	32	do	Typical	do	Do.
13	do	do	do	Do.	33	do	do	do	Do.
14	do	do	do	Do.	34	do	do	do	Do.
15	do	Typical	do	Do.	35	Pole cluster	Small	do	Dark.
16	do	do	do	Do.	36	do	Typical	do	Typical.
17	do	Small	do	Small.	37	do	do	do	Do.
18	do	Typical	do	Typical.	38	do	do	Long	Do.
19	do	do	Long	Dark.	39	do	do	Typical	Do.
20	do	Small	Typical	Typical.	40	Small leaf	Small	do	Do
					41	do	do	Short	Dark.

FIG. 1.—TYPE PLANTS REPRESENTING CLASSES USED IN GROUPING OFF-TYPE PLANTS

The types represented are: *a*, Small-leaf, early plant; *b*, typical plant; *c*, close plant; *d*, cluster plant; *e*, open plant

FIG. 2.—THE SAME PLANTS SHOWN IN FIGURE 1, WITH THE LEAVES REMOVED TO SHOW THE FRUITING-BRANCH DEVELOPMENT

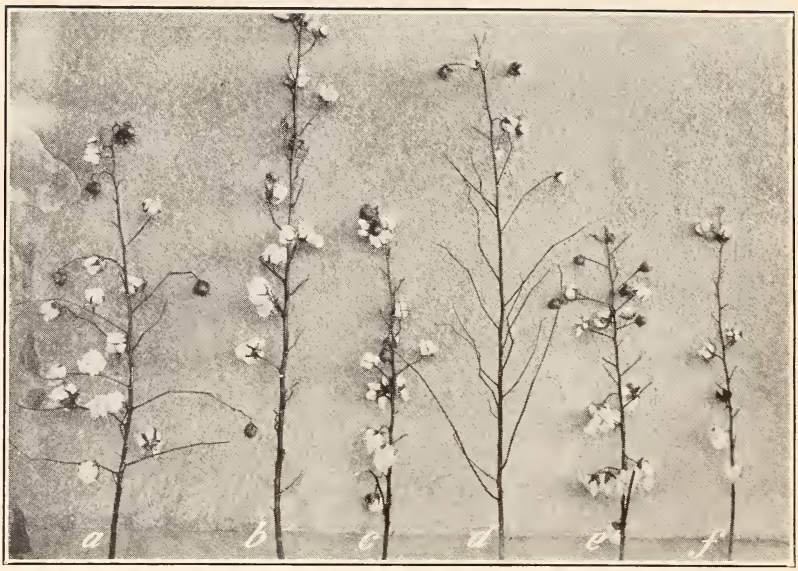


FIG. 1.—INHERITANCE OF OFF-TYPE COTTON CHARACTERISTICS

Diverse types of plants are shown, representing uniform progeny rows grown from off-type selections, compared with a normal Acala plant: *a*, Normal Acala; *b*, pole-cluster progeny 36; *c*, cluster progeny 32; *d*, open progeny 11; *e*, typical progeny 10; *f*, cluster progeny 33

FIG. 2.—DIVERSE PROGENY OF AN OFF-TYPE PLANT, SHOWING THE DIFFERENT TYPES OF COTTON PLANTS REPRESENTED IN PROGENY 27, FROM A POLE CLUSTER

Note the productive cluster plants (*a* and *b*), the semicluster plant (*f*), and the two open late unproductive types, one tall (*d*) and the other short (*c*)

FIG. 1.—PRODUCTIVE OFF-TYPE COTTON PROGENY

This shows plants in progeny row typical 10, which were very uniform and productive, with small bolls, short and sparse lint, and small and dark seeds. Plate 5, *c*, shows combed seeds from consecutive plants of this progeny

FIG. 2.—STERILE OFF-TYPE COTTON PROGENY

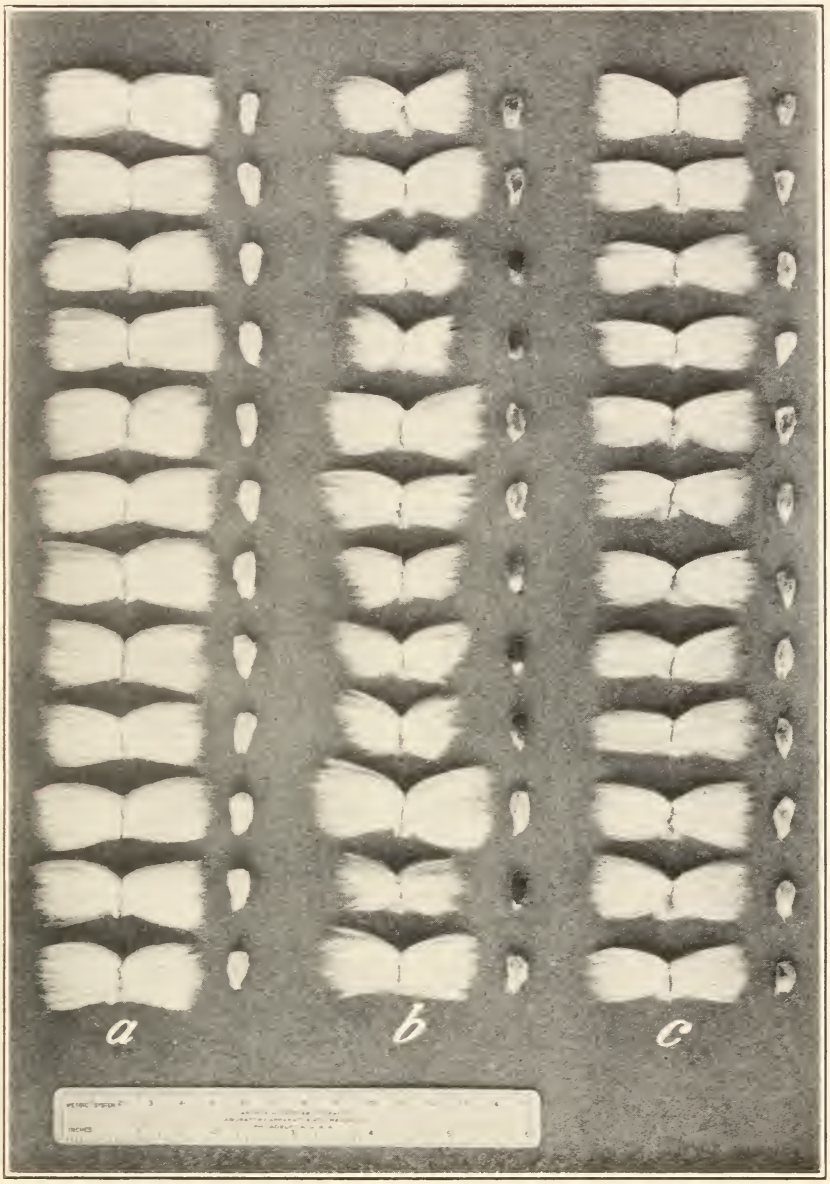
This shows plants in progeny row open 11, showing the uniform tall, open plants with only a few bolls set in the top growth

FIG. 1.—INHERITANCE OF THE POLE-CLUSTER TYPE OF COTTON

This shows plants in progeny row pole cluster 38—a very uniform progeny of cluster plants, with many of the fruiting branches having three or four internodes crowded into 1 or 2 inches

FIG. 2.—DIVERSE COTTON PLANTS FROM A POLE-CLUSTER SELECTION

This shows plants in progeny row pole cluster 29, indicating the wide diversity in plant forms with no two alike. The parent plant must undoubtedly have been a perjugate Pima Egyptian × upland cross



COMBED LINT AND SEEDS FROM CONSECUTIVE PLANTS OF TWO OFF-TYPE PROGENIES, COMPARED WITH NORMAL FIELD ACALA

a, Normal field Acala; *b*, typical progeny 1, showing diversity of lint and seed characters; *c*, typical progeny 10, showing lint uniform, but short and sparse

PROGENIES OF TYPICAL PLANT TYPE

By reference to Table 1 it may be seen that 10 of the parent rogues were of typical plant type, but were off type in either the boll, lint, or seed character. In the progeny blocks in 1924 five of the progeny rows were uniform, or as nearly so as could be judged, and like the parent in plant type; but all showed variations in regard to the inheritance of the character for which the parent had been off type. In other words, there were rows of Acala plants typical with respect to plant type, but showing all kinds of variations in boll shape and size, length of lint, and type of seed. These progenies were Nos. 2, 3, 5, 6, and 9 in Table 1. Each of the other five progeny rows was not only very diverse with respect to the inheritance of the off-type character of the parent but was also very diverse in plant type.

Progeny 1 is a good example of this diversity in inheritance. The parent was a typical plant type, with typical bolls, but short, butterfly lint and small, dark seeds. Eighteen plants were grown in the progeny row, 5 of which were typical in plant type, and the rest were classified as close. All the plants had small bolls, although some were smaller than others. (Table 2.) Fifteen plants had very short, sparse, butterfly lint, and 3 had normal lint. There were only 2 dark-seeded plants, 4 with normal seeds, and 12 with naked or almost naked seeds. (Pl. 5 *b*.) The heterozygous and degenerate nature of these plants was very evident.

The inferiority of some of the plants in the off-type progenies in regard to the boll, lint, and seed characters when compared with normal good Acala is shown in Table 2, which gives the percentage of lint, the seed and lint indices, the number of bolls required to produce 1 pound of seed cotton, and the number of bolls required to produce 1 pound of lint for 10 plants each of several progenies. In the data presented for plants from typical progeny 1 it can be seen that the seeds were very variable in size, ranging from 6.40 to 13.40 grams per 100; that the percentage of lint is often below normal; that the number of bolls required to produce 1 pound of seed cotton ranged from 96 to 270, and the number of bolls required to produce 1 pound of lint ranged from 319 to 912. When these data are compared with those of the normal Acala in the first section of the table the inferior and degenerate nature of the plants is readily appreciated.

On the other hand, the progeny of plant 2, which had the same plant, boll, lint, and seed characters as progeny 1, was uniform except for 2 tall, late, unproductive plants and 1 semicluster. The lint, however, was very short and sparse on all plants but 1, and the seeds were normal on 2 plants, dark on 5 plants (like parent), and naked or almost naked on 19 plants. This progeny, like the preceding one, would seriously impair the quality of Acala lint as well as reduce the yield.

Attention should be called to the fact that both of the parent rogues had been of such a nature that they would not have been recognized and removed from a field in the ordinary roguing operations, where only plant characters or plant and boll characters are inspected.

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The only other progenies in the typical plant group that seem worthy of note are some of those that were selected for green seed. It can be seen in Table 1 that the parent plants of progenies 7 and 8 were off type only because of sparse lint and green seed, whereas progeny 10 had small bolls, short, sparse lint, and small, green seeds. Progeny 7 was definitely diverse, 7 plants being of close plant type and the remaining 10 typical. Six of the plants had small bolls, 4 of these plants being of the close type. Eleven short or very short linted plants were found, many of which had also sparse lint. All but 2 plants had bright-green seeds, the 2 exceptions having normal seeds.

The green-seed character was hardly apparent in progeny row 8 or in row 10. Progeny 8 had no plants with green seeds, but nearly all of them had a brownish green color. Most of the plants were of the close type, with normal bolls, though there was one tall, very open plant with small round bolls and almost naked black seed. The green color was not shown in progeny 10, which had uniformly small, dark seeds.

PROGENIES OF OPEN PLANT TYPE

The most uniform progeny rows were obtained from the open-type parents. Progenies of 13 such plants were grown, because there had been some doubt about the inheritance of this plant type.

It may be seen in Table 1 that practically all of the open plant rogues were typical in other characters, with the exception of boll size. Seven of the 13 rogues had small bolls.

All but two progeny rows were uniform and like the parents. A general description of the group should suffice, since the individuals were very nearly alike. The outstanding feature was the unfruitful habit of the plants, a feature which had been observed in nearly all of the parent rogues. Little or no fruit was set on the lower part of the plants, and only a few scattering bolls were matured on the ends of fruiting branches or in the top growth (pl. 2, fig. 1, *d*, and pl. 3, fig. 2). The open character of the plants was very striking, the main stalks being taller than normal, whereas the fruiting-branch internodes were longer and inclined to be somewhat smaller in diameter than normal.

None of the parent plants had short lint, and two of them had longer lint than typical. The progeny rows, like the parent plants, were found to be very uniform in regard to this character.

Only two of the open-type parent plants had off-type seeds; one had dark seeds, and one small seeds. The dark-seeded parent produced a diverse progeny, and most of the plants had typical seeds. A uniform progeny of plants with small seeds was obtained from the small-seeded parent. All except two of the typical-seeded parents produced progenies of plants with typical seeds. Progeny 17 produced plants with a wide variation in seed size, and some of them were dark seeded. The variation in seed size is shown in Table 2. The plants in progeny 12 were very uniform in producing small seeds, as may be seen in Table 2.

TABLE 2.—*Data from 10 representative plants of normal field Acala compared with data from representative plants each in 4 off-type progeny rows*

Progeny and plant No.	Percentage of lint	Seed index[1]	Lint index[2]	Number of bolls per pound of—	
				Seed cotton	Lint
Normal field-run Acala:					
1	31.1	11.90	5.38	78	250
2	31.5	13.60	6.26	72	228
3	32.9	14.78	7.25	76	231
4	34.8	14.10	7.54	90	258
5	32.2	14.12	6.71	66	206
6	32.2	12.40	5.89	74	230
7	34.9	13.00	6.97	73	209
8	32.5	14.80	7.13	78	240
9	29.8	13.00	5.52	84	282
10	30.3	13.30	5.28	69	228
Average	32.22	13.50	6.39	76	236.2
Typical plant type progeny No. 1:					
1	31.1	9.08	4.10	169	546
2	29.7	10.50	4.44	128	431
3	28.2	8.30	3.26	179	635
4	30.1	13.40	5.77	96	319
5	30.6	6.40	2.82	270	912
6	32.0	11.60	5.46	103	322
7	27.7	12.78	4.90	123	444
8	27.2	11.30	4.22	205	752
9	27.8	8.00	3.08	224	806
10	32.5	11.15	5.36	112	345
Average	29.69	10.25	4.34	160.9	551.2
Open plant type progeny No. 17:					
1	34.9	11.63	6.24	90	258
2	33.7	12.36	6.28	83	246
3	27.5	10.58	4.01	261	950
4	33.6	11.44	5.97	93	277
5	32.8	12.00	5.86	85	259
6	34.5	8.56	4.50	253	734
7	30.3	8.12	3.53	290	957
8	32.8	11.03	5.39	80	244
Average	32.5	10.71	5.22	154.3	490.6
Open plant type progeny No. 12:					
1	32.8	10.80	5.27	114	348
2	34.9	10.35	5.55	125	358
3	32.1	10.53	4.97	113	352
4	30.0	11.00	4.57	118	393
5	28.6	10.20	4.10	113	395
6	32.4	10.60	5.10	113	349
7	27.4	11.10	4.20	107	390
8	31.2	10.20	4.63	113	362
9	32.0	10.42	4.81	107	334
10	32.2	10.05	4.80	121	376
Average	31.36	10.52	4.80	114.4	365.7
Cluster plant type progeny No. 27:					
1	29.4	12.35	5.14	78	265
2	30.6	13.63	6.01	70	229
3	32.4	13.20	6.32	72	222
4	34.8	11.80	6.30	77	221
5	33.7	12.50	6.36	81	240
6	29.4	12.40	5.16	80	272
7	34.8	11.70	6.24	82	235
8	31.7	12.10	5.62	81	255
9	32.6	12.70	6.14	76	233
10	33.3	11.00	5.50	83	249
Average	32.27	12.34	5.88	78	242.1

[1] Weight in grams of 100 seeds.

[2] Weight in grams of lint from 100 seeds.

Progeny rows 17 and 19 in this plant type were not uniform. The parent plant of progeny 17 was of open type with small leaves, small bolls, but typical in lint and seed characters. The progeny was notably diverse, although there were only eight plants. Three individuals apparently were among the worst of the degenerates. Two of them were very small plants with very small leaves and short, slender internodes. They had very small, round bolls only about five-eighths to three-fourths of an inch in diameter, lint one-half inch long, and small, fuzzy seeds. The other plant was tall, but small leafed, with long fruiting-branch internodes that also were small in diameter. It had bolls of about the same size and shape as the two small plants, but lint five-eighths of an inch long, and small, very dark seeds. The remaining five plants were large, coarse, and unproductive, two with small bolls and three with normal bolls, but all having normal lint and seed. (See data in Table 2.)

Progeny 19 was the other diverse progeny in this group. The parent was selected from the large Acala strain as a late, unproductive, open-type plant, with fruiting branches having many long internodes. The bolls were normal, the lint longer than normal, and the seed dark. The progeny row exhibited a very diverse series of plants, but the outstanding feature of this row was the tendency to throw semicluster plants. All of the plants appeared to have the normal Acala bolls and lint, but a few plants had dark seed.

PROGENIES OF CLOSE PLANT TYPE

Only three plants of the close plant type were selected.

Progeny row 24 was very uniform and like the parent. In a population of 35 all plants had small bolls but 1, and all had normal lint but 2.

Progeny row 25 did not resemble the parent type in any respect. The parent plant was a small-leafed, close type, with small, round bolls, short lint, and a dark, greenish seed. In this progeny 2 plants in a row of 21 were of the close plant type, all of the rest being normal. Sixteen plants had small bolls, the other 5 having typical bolls. Only 3 plants inherited short lint, all of the rest being typical. Five plants had green seeds, 1 dark seeds, 8 brown seeds, and 7 typical seeds. The combinations of characters as recorded in these plants were particularly varied and very interesting, but the data in detail are too bulky to present.

A wide diversity of plants was found in progeny row 26. Some plants were true clusters, a few were like the parent, and some were of typical plant type. As a rule the plants were not productive and had lost all of their bottom and middle crop, although there were a few individuals with bolls fairly well distributed. The unusual feature of this progeny was the fact that the boll, lint, and seed characters seemed to remain uniform, regardless of the diversities in plant type.

PROGENIES OF CLUSTER PLANT TYPE

Cluster variations are of such frequent occurrence and so well known that only a general discussion of the results obtained will be presented. Pole-type clusters will be included.

Twelve selections were made for clustering, and in all cases the clustering habit was apparent in the progeny row, usually very uni-

formly (pl. 4, fig 1). Most of the cluster plants were selected for clustering alone, since they were typical in respect to boll, lint, and seed characters.

Progeny rows 27, 28, 29, and 31 in the clusters and 37, 38, and 39 in the pole clusters were uniform and like the parent plants. Their general character may be found in Table 1. Cluster plants are often very productive and may appear desirable, but they have several objectionable characters, chief among which are the excessive shedding of bolls and the difficulty in keeping trash out of the lint in picking. In addition, many of the pedicels or flower stems are decurrent, or with an imperfect joint at the base, so that aborted squares and bolls hang on the plant instead of falling to the ground. This abnormality is highly undesirable under boll-weevil conditions, where the natural control of the weevils depends largely on the heat of the ground to kill the young larvæ in the aborted buds.

Five of the cluster progeny rows were diverse. The extent of the diversity can be seen in Plate 2, Figure 2, and Plate 4, Figure 2, which show plants from two of the progeny rows. These progenies can not be discussed in detail, but some idea may be conveyed as to the extent of their diversity. Three of the five progenies contained a series of individuals with hardly any two plants that could be said to look alike. They ranged from small, sterile, extreme clusters to almost sterile, large, coarse, open-type plants (pl. 4, fig. 2). All types of plants could be found, as well as the worst deviations from typical in all of the other characters that were being recorded. Many plants had very small bolls, and others had short, spare lint of the poorest quality and the widest diversity in seed types, from green fuzzy to naked ones (pl. 5, *b*). There is no adequate means of expressing the degeneracy exhibited in these progeny rows or the damage that such plants might do if permitted to remain in a good strain of cotton.

The fact that cluster variations proved heritable is in itself sufficient to prove them undesirable in Acala cotton. It would also seem that clustering might be a common indication of hybridization or of unstable heredity, judging from the extent of the diversity obtained in a few of the progeny rows.

PROGENIES OF SMALL-LEAFED, EARLY TYPE

Several productive small, early plants with small bolls were noted in the Acala in 1923, and two progenies of this type were raised. The parent plants seemed to have a determinate habit of growth, being only about 18 inches high, whereas the adjoining plants were more than twice that height. Also they had produced a good crop of bolls that were open to the top of the plants, whereas the neighboring plants had many green bolls in the top growth. Otherwise they would have been called typical in regard to plant type.

The progeny rows did not exhibit a definite determinate habit of growth, although the plants were somewhat shorter than their neighbors. Both rows showed definitely early and prolific behavior. Progeny 40 was fairly uniform, a few plants tending toward a close-fruiting habit. Progeny 41, however, was very diverse, only 5 plants being normal, the rest being divided into 4 of the open type, 12 of

the close type, and 6 of the cluster type. Both progenies were uniformly small bolled; short lint was uniformly inherited in progeny 40 and typical lint in progeny 41.

SUMMARY

In a study of the progenies of off-type plants selected from fields of Acala cotton in Arizona, the divergent characters were found to be inherited. The series of off-type plants used in the experiment are grouped for purposes of description into a few classes or types with reference to habits of growth and other characters covering most of the diversities appearing commonly in the Acala variety.

The experiment included progenies grown from plants that were off-type in leaf, stalk, and fruiting-branch characters, such as open, long-jointed plants, close, short-jointed plants, and cluster plants, with brachytic fruiting-branch internodes. Also, a series of progenies was studied to note the inheritance of small bolls, short and sparse lint, and various seed characters, including dark fuzz, green fuzz, and naked seeds with little or no fuzz.

Many of the progeny rows appeared surprisingly uniform, considering that they were grown from open-pollinated seed. Usually the resemblance of the off-type character or characters noted in the parent selection was very apparent in the progeny. However, several progenies were extremely diverse, and it was evident that they were of hybrid origin.

The information presented will make clearer the need of careful and continued selection in cotton and also will assist in the recognition of off-type plants in the roguing of fields where seed is grown for planting.

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September 1, 1926

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